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Serial No: 10/749,578

Remarks

Applicant and his representatives wish to thank Examiner Booth for the examination of the present application, the explanations in the Office Action dated January 5, 2006, and for the telephone interview on March 21, 2006. As discussed in the interview, independent Claim 2 has been amended to clarify that a planarized insulation film is etched sufficiently to form the contact hole or the via hole using a plasma having a spiral movement also results in rounding of the top edge of the contact hole or via hole. The amendments are consistent with the specification as filed, wherein the plasma etching step that creates the contact hole or via hole also rounds the edges of the hole (see, e.g., pages 3 and 4, paragraphs [0016] and [0017]). In addition, Applicants wish to add a new set of claims containing substantially similar limitations, but in which the contact or via hole is formed in a generic insulation layer (of which the metal insulation layer and the interlayer insulation layer are species). Thus, support for new Claims 12-19 may be found in original Claims 1-9 as filed. Support for new Claims 10 and 20 may be found on page 4, paragraph [0018]. Support for new Claims 11 and 21 may be found on page 4, paragraph [0019]. Therefore, no new matter is introduced by the present amendments.

The present invention relates to a method for forming a contact hole (or a via hole) in a semiconductor device. The method (as set forth in Claim 2, as amended above) generally includes the steps of (a) applying, exposing and developing a photosensitive film on a planarized metal insulation film or a planarized interlayer insulation film to form a photosensitive film pattern on a region to contain the contact hole or the via hole, and (b) dry etching the planarized metal insulation film or the planarized interlayer insulation film using the photosensitive film pattern as a mask and using a plasma having spiral movement sufficiently to form the contact hole or the via hole and round a top edge of the contact hole or the via hole thereby. As stated above, new Claim 12 contains similar limitations.

The references cited against the originally-filed claims (Kwak et al, U.S. Pat. No. 5,940,730 [hereinafter "Kwak"] and Yoshiki et al., U.S. Pat. No. 5,843,236 [hereinafter "Yoshiki"]) neither disclose nor suggest dry etching a planarized insulation film with a plasma

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having spiral movement sufficiently to form the contact hole or the via hole and round a top edge of the contact hole or the via hole thereby. Consequently, the present claims are patentable over the cited references.

The Rejection of Claim 2 under 35 U.S.C. § 103(a)

The rejection of Claim 2 under 35 U.S.C. § 103(a) as being unpatentable over Kwak in view of Yoshiki is respectfully traversed.

Independent Claim 2 and 12 recite a method comprising the step of dry etching the planarized insulation film, using the photosensitive film pattern as a mask and using a plasma having spiral movement, sufficiently to form the contact hole or the via hole and round a top edge of the contact hole or the via hole thereby.

Kwak relates to a method of forming a contact hole, but Kwak performs at least two different etching steps to form its hole with a rounded edge (see Col. 2, lines 27-32). Kwak teaches a method of forming a contract hole including the steps of (a) etching the interlayer insulating layer to a predetermined depth by an isotropic etching process, (b) etching the remaining thickness of the insulation layer by an anisotropic etching process, (c) performing first and second plasma etching processes using an inert gas to round the entrance to the contact hole (see, e.g., Kwak, col. 2, lines 27-57). Kwak, therefore, creates the contact holes *prior* to plasma etching, and *prior* to rounding the edge of the hole. Kwak does not teach or suggest a step of dry etching an insulation film with a plasma having spiral movement sufficiently to form the contact hole and round the edge of the contact hole thereby.

Yoshiki relates to an apparatus for performing plasma etching, wherein the plasma has a spiral motion. Yoshiki does not disclose or suggest any procedure for making contact holes, as an electronic text search of the Yoshiki text reveals. Thus, if Kwak and Yoshiki are combined, the result is a method wherein plasma etching, with a plasma moving in a spiral pattern, is performed *after* the contact hole is created. Therefore, Yoshiki fails to correct Kwak's deficiency with respect to a single dry etching step with a plasma having spiral movement to form the

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contact hole or the via hole wherein a top edge of the contact hole or the via hole is rounded in the same step. Therefore, the combination of Kwak and Yoshiki fails to disclose all of the limitations of independent Claims 2 and 12. Accordingly, the rejection of independent Claim 2 under 35 U.S.C. § 103(a) as being unpatentable over Kwak and Yoshiki is improper, and should be withdrawn. New independent Claim 12 and dependent Claims 3-11 and 13-21 are also patentable over Kwak and Yoshiki for the same reason.

The Rejection of Claim 3 under 35 U.S.C. § 103(a)

The rejection of Claim 3 under 35 U.S.C. § 103(a) as being unpatentable over Kwak in view of Yoshiki and Mihara (U.S. Patent No. 5,681,780) is respectfully traversed.

Mihara relates to a method of etching a contact hole using fluorocarbon gas. Mihara does not teach or suggest dry etching an insulation film with a plasma having spiral movement, nor does Mihara teach or suggest dry etching an insulation film sufficiently to form the contact hole and round the edge of the contact hole thereby. Thus, Mihara fails to correct the deficiencies of Kwak and Yoshiki with respect to dry etching an insulation film with a plasma having spiral movement sufficiently to form the contact hole and round the edge of the contact hole thereby, as recited in independent Claims 2 and 12. Therefore, the combination of Kwak, Yoshiki, and Mihara fails to disclose all of the limitations of dependent Claims 3 and 15. Accordingly, the rejection of Claim 3 under 35 U.S.C. § 103(a) as being unpatentable over Kwak in view of Yoshiki and Mihara is improper, and should be withdrawn. new dependent Claim 15 is also patentable over Kwak in view of Yoshiki and Mihara for the same reason.

The Rejection of Claims 4-7 under 35 U.S.C. § 103(a)

Claims 4 and 5 have been cancelled. The rejection of Claims 6 and 7 under 35 U.S.C. § 103(a) as being unpatentable over Kwak in view of Yoshiki and Lee (U.S. Patent No. 5,998,870) is respectfully traversed.

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Lee relates to a method of forming a contact in a contact hole. Lee does not teach or suggest dry etching an insulation film with a plasma having spiral movement, nor does Lee teach or suggest dry etching an insulation film sufficiently to form the contact hole and round the edge of the contact hole thereby. Thus, Lee fails to correct the deficiencies of Kwak and Yoshiki with respect to dry etching an insulation film with a plasma having spiral movement sufficiently to form the contact hole and round the edge of the contact hole thereby, as recited in independent Claims 2 and 12. Therefore, the combination of Kwak, Yoshiki, and Lee fails to disclose all of the limitations of dependent Claims 6 and 7 and new dependent Claims 16 and 17. Accordingly, the rejection of Claims 6 and 7 under 35 U.S.C. § 103(a) as being unpatentable over Kwak in view of Yoshiki and Lee is improper, and should be withdrawn. New dependent Claims 16 and 17 are patentable over Kwak in view of Yoshiki and Lee for the same reason.

The Rejection of Claims 8 and 9 under 35 U.S.C. § 103(a)

The rejection of Claims 8 and 9 under 35 U.S.C. § 103(a) as being unpatentable over Kwak in view of Yoshiki, Mihara, and Lee is respectfully traversed.

As shown above, Mihara and Lee both fail to correct the defects of Kwak and Yoshiki with respect to dry etching an insulation film with a plasma having spiral movement sufficiently to form the contact hole and round the edge of the contact hole thereby, as recited in independent Claims 2 and 12. Therefore, the combination of Kwak, Yoshiki, Mihara, and Lee fails to disclose all of the limitations of dependent Claims 8 and 9 and new dependent Claims 18 and 19. Accordingly, the rejection of Claims 8 and 9 under 35 U.S.C. § 103(a) as being unpatentable over Kwak in view of Yoshiki, Mihara, and Lee is improper, and should be withdrawn. New dependent Claims 18 and 19 are patentable over Kwak in view of Yoshiki, Mihara, and Lee for the same reason.

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Conclusions

In view of the above amendments and remarks, all bases for objection and rejection are overcome, and the application is in condition for allowance. Early notice to that effect is earnestly requested.

If it is deemed helpful or beneficial to the efficient prosecution of the present application, the Examiner is invited to contact Applicant's undersigned representative by telephone.

Respectfully submitted,



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